Single family House - Bern, Switzerland

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Double-shell masonry wall

Walls

What is the solution?

The listed neo-baroque style single family house in Bern/BE, dated 1898, has been extensively renovated and thermally refurbished between 2011 and 2015. The intervention concerns the thermal improvement of the envelope, intervening on walls, roof and windows. Due to the high level of protection as the building is listed in Cantonal inventories, the challenge was to achieve maximum results in both fields energy efficiency and heritage protection, opting for several high efficiency interventions, but at the same time with minimum aesthetic impact. For this reason, the external wall was insulated with a double-shell blowing system with Isofloc H2Wall. This is the best possible insulation for an external wall, as reported in the cantonal buildings inventory. This was a premiere in Bern. In addition, it has been included on the inside a wall heating with 1 cm aerogel insulation (corresponds to 3 cm of conventional insulation).

Cross section of the wall build-up, available pictures of the solution:

External renovation process © M. Hutterli

Double-shell blowing system with Isofloc H2Wall © M. Hutterli

Internal wall intervention © M. Hutterli

Internal intervention © M. Hutterli

Internal wall after intervention © M. Hutterli

Intervention to improve thermal insulation of external walls. © M. Hutterli

Why does the solution work in terms of compatibility with conservation, moisture safety and energy improvement?

The intervention maintains the original aesthetics of the wall and the increase in wall thickness is minimal. This way, the interior space of the building remains practically unchanged. Many houses built between 1900 and 1970 have cavity walls. The outer shell, usually a brick facade or plastered masonry, provides protection against the weather. Behind this there is a 40-100 mm cavity and the internal shell is usually the load bearing wall. A lot of valuable heat energy is lost via an un-insulated external wall. The retrofit solution used in this project, Isofloc H2WALL (isofloc® pearl,) is made from an EPS-based raw material granulate that has been refined with graphite specially developed for effective, cavity-free filling of double-shell masonry. For retrofitting of the double-shell wall construction, the EPS granulate is blown into the previously free air space through blow-in holes in the front wall shell and the openings are closed again with plaster or mortar of the same colour.

Description of the context:

The building is a detached single-family house, a two-floors neo-baroque construction with a mansard rooftop and is dated 1898. The general situation of degradation and the need to minimize energy demand collide with the

important aspect of historic buildings preservation. As usual at road forks and corner houses in the Kirchenfeld district, according to the Kirchenfeld-Brunnadern building inventory, the house was designed with special care: the south-east corner of the house is characterized by a corner risalite, which is covered with the mansard roof. The house is listed in the cantonal building inventory and classified as worthy of protection (highest protection level). For this reason, any changes must obtain the approval of the Department of Historic Monuments.

Pros and cons of the solution:

Pros are that the intervention is aesthetically minimal and at the same time thermal comfort highly increases, thanks to the wall radiators that guarantee a good heat diffusion. New technologies as the double-shell blowing system are an important improvement in renovation projects. This retrofit solution is suitable for exterior walls and is characterized by low thermal conductivity (λ = 0,033). It is water-repellent and completely recyclable. The vapor-permeable granulate is resistant to aging and rot. Other advantages are: Less expensive because the insulation is blowed in the cavity core of existing walls using small injection openings with minimal cross-section intervention with complete cavity filling; Low moisture absorption due to its water-repellent property; Settlement-proof and can be processed without joints.

Additional Information:

Huge energy savings are possible with this insulation measure. Because the aeration of the air layer is prevented by cavity wall insulation, the surface temperature of the internal wall surfaces increases. That contributes towards a high level of comfort for the inhabitants. The existing living space is not stressed or affected by the retrofitted insulation, which is only on the cavity existing space inner layers of the wall. The thermal transmittance value of the wall was significantly reduced after the intervention (U-value pre-intervention 0.68 W / m2K; U-value post-intervention 0.44 W / m^2K). Furthermore, top roof attic, basement ceiling as well as all the ceilings of the family house were insulated with cellulose. The builders used Isofloc H2Wall granulate, which is now called Pearl, in the two-shell masonry of the building. "This insulation material is considered state of the art for the exterior walls of objects in the cantonal building inventory. It is also very inexpensive because it can be blown in," as stated by the building owner, which is also energy consultant very involved in the conscious conservation of its building to preserve its heritage

value. Furthermore, as window panes were replaced by insulating glass (windows were insulated with the krypton gas), while the historical original window frames were retained or reconstructed both strategies together have made possible to achieve a building envelope with high thermal performances. Article and video published in Hausinfo, a neutral online information platform on all topics relating to the house, published in German and French (Ed. GVB Services AG and the Home Owners Association Switzerland, HEV): "Architecture report: Energy-producing roof despite monument protection". The article contains information on the products and the technical plans used in the building refurbishment. Available at: https://www.hausinfo.ch/de/home/gebaeude/architekturreportagen/hutterli-bern.html

Is there any related publication? If yes, please provide any available link or document for further reading

https://www.hiberatlas.com/smartedit/projects/174/g-14-10-03_hutterli_roethlisberger_solpreiskatsan.pdf
Swiss solar price 2014 (German)

Link to best practice example (Hiberatlas):

https://www.hiberatlas.com/en/single-family-house-bern-switzerland--2-174.html